Telecommunications network measurements of online gambling behavior in switzerland: a feasibility study

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Abstract: BACKGROUND: Methodological shortcomings of gambling studies relying on self-report or on data sets derived from gambling operators tend to result in biased conclusions. The aim of this study was to analyze online gambling behavior using a novel network database approach. METHODS: From October 13 to October 26, 2014, telecommunications network data from a major telecommunications provider in Switzerland were analyzed. Netflows between mobile devices and a poker operator were quantified to measure the gambling duration and session number. RESULTS: Time spent gambling during night and working hours was compared between devices with longest (red group), intermediate (orange group), and shortest gambling time (green group). Online gambling behavior differed depending on overall gambling time, F (2, 3,143). Night and working hours gambling was the highest in the red group (53%), compared to the orange (50.1%) and the green groups (41.5%). Post hoc analyses indicated significant differences between the orange and green groups ($p < 0.05$). No differences were observed between the red and orange groups ($p = 0.850$), and the red and green groups ($p = 0.053$). CONCLUSIONS: On mobile devices, distinct gambling patterns were observed depending on the overall gambling time. This methodology could also be used to investigate online gaming, social media use, and online pornography.

DOI: https://doi.org/10.1159/000471482

Originally published at:
Bitar, Raoul; Nordt, Carlos; Grosshans, Martin; Herdener, Marcus; Seifritz, Erich; Mutschler, Jochen (2017). Telecommunications network measurements of online gambling behavior in switzerland: a feasibility study. European Addiction Research, 23(2):106-112.
DOI: https://doi.org/10.1159/000471482

Research Report

European Addiction Research

Eur Addict Res 2017;23:106–112
DOI: 10.1159/000471482

Received: August 23, 2017
Accepted: March 15, 2017
Published online: April 13, 2017

Telecommunications Network Measurements of Online Gambling Behavior in Switzerland: A Feasibility Study

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Keywords
Online poker · Online gambling · Gambling behavior

Abstract
Background: Methodological shortcomings of gambling studies relying on self-report or on data sets derived from gambling operators tend to result in biased conclusions. The aim of this study was to analyze online gambling behavior using a novel network database approach. ***Methods:*** From October 13 to October 26, 2014, telecommunications network data from a major telecommunications provider in Switzerland were analyzed. Netflows between mobile devices and a poker operator were quantified to measure the gambling duration and session number. ***Results:*** Time spent gambling during night and working hours was compared between devices with longest (red group), intermediate (orange group), and shortest gambling time (green group). Online gambling behavior differed depending on overall gambling time, F (2, 3,143). Night and working hours gambling was the highest in the red group (53%), compared to the orange (50.1%) and the green groups (41.5%). Post hoc analyses indicated significant differences between the orange and green groups ($p < 0.05$). No differences were observed between the red and orange groups ($p = 0.850$), and the red and green groups ($p = 0.053$). ***Conclusions:*** On mobile devices, distinct gambling patterns were observed depending on the overall gambling time. This methodology could also be used to investigate online gaming, social media use, and online pornography.

Introduction

Internet gambling is steadily increasing in popularity due to a fast-growing online gambling industry [1]. Although most players gamble for fun and never experience serious gambling-related problems, a small proportion of players will experience serious financial and health consequences [2]. These gamblers have great difficulty resisting the impulse to gamble and may fail to control gambling behavior despite negative consequences leading to a detrimental behavior in their personal, business, or family environment [3].

As a result of accessibility, anonymity, affordability, convenience, interactivity, and disinhibition, it has been argued that Internet gambling is a particularly hazardous

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form of gambling [4, 5]. Accordingly, a number of studies have shown substantially higher rates of gambling disorder among Internet gamblers when compared to non-Internet gamblers [4, 6, 7]. However, most of these studies are based on self-report surveys, which often exhibit relatively low sample sizes, participant selection bias, low response rates, memory distortions, human error, and self-presentation bias [8, 9].

With the emergence of online-gambling and data-mining procedures, it is now possible to capture, analyze, and process large data sets on gambling behavior (e.g., gambling time, gambling frequency) to extract reliable and objective information [10, 11]. A series of studies, for example, has analyzed data sets of gambling accounts derived from bwin Interactive Entertainment AG (bwin), a large European Internet gambling operator [12–14]. Account-based gambling refers to wagering from a registered customer account [10]. Overall, the results of these studies do not support earlier findings that Internet gambling is more addictive than land-based gambling [15–26]. Meanwhile, a growing body of research has focused on analyzing data sets of gambling accounts provided by various gambling operators [12, 13, 27, 28].

Aside from the aforementioned advantages, an account-based framework has certain shortcomings. Online gamblers, especially those with problem issues, use various gambling operators, and gamblers may have multiple accounts with one operator or share the account with other gamblers [29, 30]. Many studies analyzing account-based gambling data have neglected gamblers' entire involvement across multiple types of gambling (e.g., poker, casino games, sports wagering), focusing instead on individual forms of gambling [17–21, 23]. However, involvement in multiple forms of gambling has emerged as a potential indicator of problematic gambling behavior [14, 31–37]. In line with this, further analysis of the "bwin" data revealed overall gambling involvement as an important predictor of potential harm, and associating online gambling with increased risks compared to land-based gambling, contradicting previous results [14]. An additional drawback of account-based studies is that they rely on data provided by the gambling operator itself. In Switzerland "Swisslos" is the only operator, which has a license to run online lottery, sports betting, and bingo through its website [38]. Operation and marketing of other online gambling sites are not allowed. Although it is under discussion now, Swiss authorities so far neither block offshore gambling sites nor restrain residents from gambling on those sites. As no uniform global legislation or regulation exists to standardize gambling [39], these studies are susceptible to sponsorship bias. These factors strongly suggest that analysis of account-based data from single operators for individual games may result in biased conclusions, particularly on the hazards of online gambling.

Telecommunications network measurements appear to offer an interesting alternative to self-reporting and account-based approaches to studying online gambling behavior. Switzerland has one of the highest mobile phone penetration rates in Europe, which included nearly 12 million mobile contracts for a total population of over 8.2 million inhabitants in 2014 [40]. After the liberalization of the market in 1998, many providers appeared in Switzerland; however, only 3 network operators exist. In collaboration with one of these operators, we applied a novel network database approach to the analysis of gambling behavior. Focusing on one poker operator alone we intended to develop and test this new methodology.

Methods

Selection Process

Poker is a strategic game and involves several actions before and during the game [41, 42]. Gamblers have to decide when and under which precondition to play. In order to play online poker, gamblers have to sign into a game. Core elements of the game are opponents' observation, decision making, and betting, inter alia. In this feasibility study, we aimed to measure time spent at a virtual poker table regardless of actions during the game.

In order to attain this goal, we quantified "netflow" [43], a particular format of network data. A netflow is logged every time a user device (e.g., tablet) generates a connection to a remote server (e.g., poker operator). Since people on the one hand share (e.g., families) and on other hand use multiple devices, netflows characterize behavior executed on a particular device rather than behavior of single persons. Therefore, gambling time is measured with a mobile device user behavior.

Ranking websites were used to capture popular poker operators [44, 45]. Net flows between the remote servers of these operators and mobile devices were quantified to estimate the number of users in Switzerland for each operator. By analyzing decompiled software from these operators, we verified that we are able to separate netflows belonging to the poker game from other types of netflows (e.g., advertisement related). Using the described parameters, we selected PokerStars [46] as the most commonly used operator in Switzerland at that time.

Data Collection

Our approach was entirely based on anonymized mobile Internet traffic data collected from a major telecommunications provider in Switzerland.

Network flows between 3,146 mobile devices from customers of the telecommunications provider and the website PokerStars were identified and analyzed for a period from October 13, 2014 to October 26, 2014.

Data Processing

Our preliminary analysis of network flows indicated the need for further data cleaning and preparation. Collected data revealed extremely short flows, which were usually separated by time intervals lasting only several seconds. Data came from mobile networks for which disconnections are quite common. Sessionization, a process of merging network flows into one, resolved this issue. In a second step, merged network flows were joined into user sessions when intervals between adjacent flows were shorter than 10 min.

Next, sessions shorter than 2 min were eliminated because this period is too short (after sessionization) for a poker game and is therefore unlikely to involve user gambling.

Data Analysis

With network data processed into user sessions, session frequency and duration were computed for each mobile device. In addition, we recorded the time of day and weekday of play.

Devices were divided into 3 groups based on percentiles of the total gambling time. We labeled the total gambling time above the 98th percentile as the red group (63 devices), between the 98th and 90th percentile as orange (252 devices), and below the 90th percentile as green (2,831 devices). We defined night (from 12:00 midnight to 8:00 a.m. on weekdays and from 12:00 midnight to 10:00 a.m. on weekends) and working hours (from 8:00 a.m. to 5:00 p.m. on weekdays) and verified whether time gambled during these times differed between the groups.

Statistical analysis included means, SDs, and cumulative distribution Functions for overviews, and one-way analysis of variance (one-way ANOVA) on summarized data for group effects on the variable "percentage of gambling during night and working hours." Levels of significance were set at 0.05 unless otherwise stated.

Technologies

The scale of data analysis required dedicated tooling to be able to deal with high data volumes. We therefore used advanced data technologies for storing and processing data [47, 48].

Apache Hadoop is an Apache Software Foundation project and open-source platform for scalable and distributed computing. Hadoop provides a distributed file system and an execution engine (YARN), which allows storage and processing of data with different processing engines at petabyte scales.

Apache Spark is also an Apache Software Foundation project and open-source processing engine for large-scale data processing.

Privacy

All data were anonymized and aggregated according to best practice in such a way as to make individual reidentification impossible.

To ensure privacy, the following steps were performed: (i) only flow data relevant to the operator (PokerStars) were kept, (ii) all user-identifiable features (e.g., IP addresses) were discarded and replaced with randomly generated anonymous identifiers, (iii) only aggregated results are presented in the present report, (iv) the dataset was erased after analysis.

The local Ethics committee confirmed that analysis of anonymized and aggregated data for research purposes is permitted.

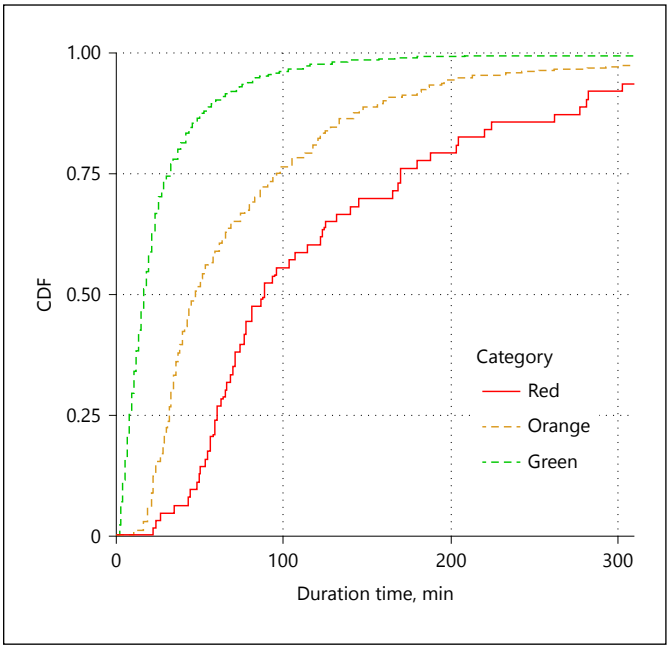

Fig. 1. The figure presents the proportion of gamblers for each group that gamble less than or equal to a given average session duration. The session durations are presented in minutes. The distributions of the groups are marked red, orange, and green.

Table 1. Usage statistics

	All	Green	Orange	Red
Number of devices, *n*	3,146	2,831	252	63
Total duration, h, mean	3.97	1.82	17.21	47.65
Session duration, h, mean	0.62	0.42	0.77	1.38
Number of sessions, *n*, mean	6.40	4.36	22.31	34.43
Gambling during problematic gambling times, %, mean	42.4	41.5	50.1	53.1

Results

Data collection identified 20,124 user sessions generated by 3,146 mobile devices. Dependent on their total gambling time, devices were divided into 3 categories with 2,831 devices in the green group, 252 devices in the orange group, and 63 devices in the green group.

Duration

Gambling time over a 2-week period ranged from 3 min to 112.22 h (mean = 3.97, SD 8.30; see Table 1). An average session lasted 37 min (SD 1.20). Figure 1 shows the cumulative distribution of average durations of user

Eur Addict Res 2017;23:106–112
DOI: 10.1159/000471482

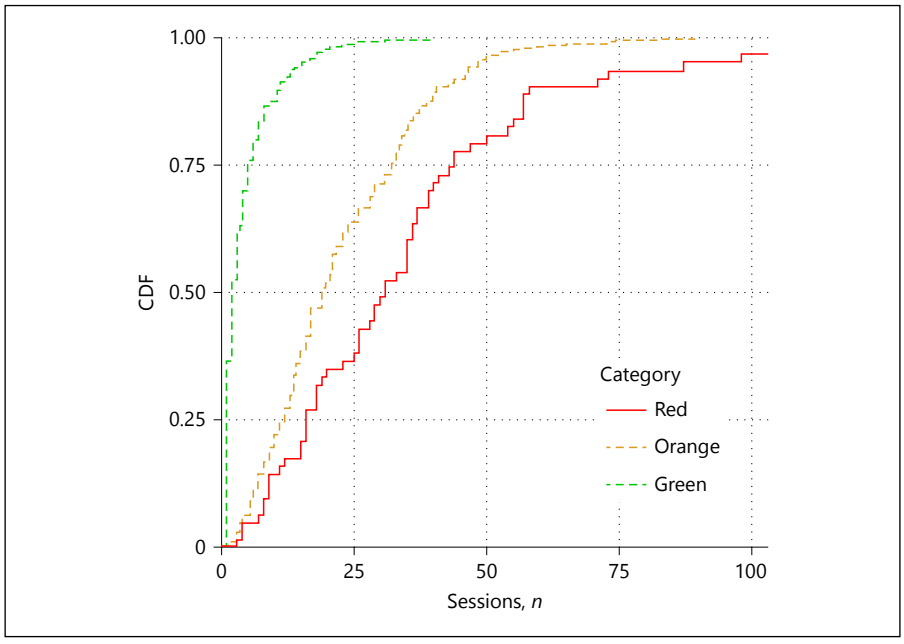

Fig. 2. The figure presents the proportion of gamblers for each group that gamble less than or equal to a given average number of user sessions. The distributions of the groups are marked red, orange, and green.

sessions. On an average, 75% of sessions last less than 28 min for the green group, 47 min for the orange group, and 1.48 h for the red group.

Frequencies

Individuals gambled on an average of 6.4 sessions (SD 9.64) over 2 weeks (Table 1). Figure 2 shows the cumulative distribution of the number of user sessions for each group. The median value was 2 sessions for the green group, 19 sessions for the orange group, and 31 sessions for the red group.

Daytime Play

The green group gambled rarely between 12:00 midnight and 7:00 a.m. during weekdays, as indicated by the white fields in Figure 3. Most of the gambling took place during lunchtime, in the evening, or on Sunday afternoons (darker fields in Figure. 3). Periods of not gambling during night hours were less clearly identifiable in the orange group and nonexistent in the red group.

On an average, 42.4% (SD 39.4) of gambling occurred during working and night hours (Table 1). The red group gambled most during these times (mean 53.1, SD 17.8), with the orange group (mean 50.1, SD 23.2) gambling almost as long as the red group and the green group gambling least (mean 41.5, SD 40.7). A one-way ANOVA showed a significant group effect, $F(2, 3{,}143) = 7.93$. Post hoc analyzes using the Tukey HSD test indicated that the orange group gambled more during working and night hours than the green group. However, differences between the red and the orange groups ($p = 0.850$), and between the red and green groups ($p = 0.053$), were not significant.

Discussion

This study presents the first analysis of online gambling behavior determined using telecommunications network data. We were able to extract and process network data between the telecommunications provider's entire mobile subscriber base and the gambling operator PokerStars. Network data were processed into user sessions, which are at the core of this new approach and a prerequisite for a comprehensive analysis of gambling behavior based on telecommunications network data.

We extracted session time and session frequency, factors that are linked to gambling disorder [7, 29, 49, 50]. Groups differed significantly in play during daytime. The red group was most active during working and night times, while the green group was least active. However, post hoc analysis showed a difference only between the orange and green groups. This outcome can be explained by the smaller number of gamblers in the red group. Use of computers at night is not only associated with symptoms found in gambling disorder (sleep disturbances, perceived stress, symptoms of depression, and reduced performance) [51–53] but also with the gambling disor-

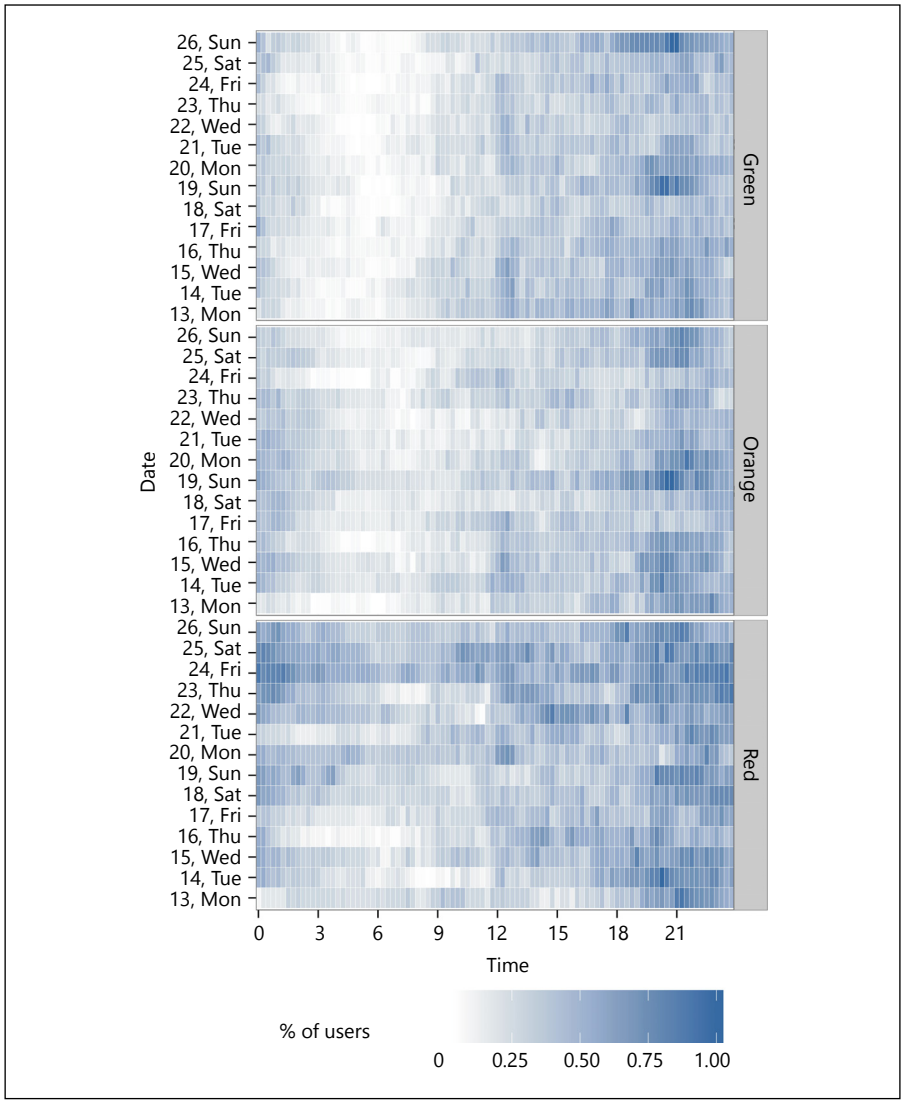

Fig. 3. The figure shows for each group the proportion of active devices during the 2 observation weeks. On the y axis, the days are listed and on the x axis, the hours of the days. Each square presents 15 min. The saturation of the squares indicates the proportion of active devices for each group. White squares display time periods with no active devices, whereas dark blue squares indicate that all devices of group are active in this time period.

der itself [54, 55]. Likewise, there are concerns regarding gambling in the workplace [56, 57]. Otherwise, the red group could represent professional players, gambling on working or night hours [58, 59].

Because our approach was based on analysis of mobile network data, we obtained data only when communications were passing over this mobile network and therefore, the results shown in this paper represent a lower bound of genuine usage. In future studies, our objective will be to extend the analysis to entire Internet use in Switzerland. We have developed methods to turn network flow data into user sessions. However, these data sets only allow us to trace and quantify connections between mobile devices and servers – we cannot analyze the content of the connection. Therefore, we are limited to interpretation of usage and are not able to detect specific gambling activities or whether players, for instance, are simply recharging their accounts. In this study, the quantifying usage of the application required a focused engineering effort to identify and understand generated network flows, and then to turn them into user sessions. Applying this manual approach to cover all available gambling operators is unrealistic. However, new techniques could be developed to address these issues. An example would be to use crowd-sourcing approaches to analyze applications/websites, or leverage other kinds of network data (e.g., DNS). Our methodology is also unable to detect when an application is left open without any interactions. We believe that this shortcoming can be substantially improved by developing new heuristics to

differentiate flows (background flows should have constant sizes and frequency, for instance, while active gambling behavior results in changes of these parameters). Also, our methodology is unable to descry who is using the mobile device. We can only measure behavior on a device and not directly from the person who is using the device.

Once these techniques have been fine-tuned and further validated; software programs could be developed to allow gamblers to monitor and understand their own gambling behavior. This new concept could be generalized and applied more broadly to encompass not only gambling but also other online services such as social media, shopping, pornography, or online gaming.

Acknowledgment

D. Watrin, M. Pietrzyk, D. Jacot, B. Alberski, and B. Moumni provided unpublished data relevant to the analyses. Neither received compensation outside of his usual salary.

References

1 Gainsbury SM, Suhonen N, Saastamoinen J: Chasing losses in online poker and casino games: characteristics and game play of Internet gamblers at risk of disordered gambling. Psychiatry Res 2014;217:220–225.
2 Petry NM: Internet gambling: an emerging concern in family practice medicine? Fam Pract 2006;23:421–426.
3 Raylu N, Oei TP: Pathological gambling. A comprehensive review. Clin Psychol Rev 2002;22:1009–1061.
4 Wood RT, Williams RJ: A comparative profile of the Internet gambler: demographic characteristics, game-play patterns, and problem gambling status. New Media Soc 2011;13:1123–1141.
5 Griffiths M: Internet gambling: issues, concerns, and recommendations. Cyberpsychol Behav 2003;6:557–568.
6 Griffiths M, et al: Sociodemographic correlates of internet gambling: findings from the 2007 British gambling prevalence survey. Cyberpsychol Behav 2009;12:199–202.
7 Wood RT, Griffiths MD, Parke J: Acquisition, development, and maintenance of online poker playing in a student sample. Cyberpsychol Behav 2007;10:354–361.
8 Shaffer HJ, et al: Toward a paradigm shift in Internet gambling research: from opinion and self-report to actual behavior. Addict Res Theory 2010;18:270–283.
9 Bullock SA, Potenza gambling: neuropsychopharmacology and treatment. Curr Psychopharmacol 2012;1.
10 Gainsbury SM: Player account-based gambling: potentials for behaviour-based research methodologies. Int Gambl Stud 2011;11:153–171.
11 Philander KS: Identifying high-risk online gamblers: a comparison of data mining procedures. Int Gambl Stud 2013;14:53–63.
12 Fiedler I: The gambling habits of online poker players. J Gamb Bus Econ 2012;6:1–24.
13 Dragicevic S, Tsogas G, Kudic A: Analysis of casino online gambling data in relation to behavioural risk markers for high-risk gambling and player protection. Int Gambl Stud 2011;11:377–391.
14 Brosowski T, Meyer G, Hayer T: Analyses of multiple types of online gambling within one provider: an extended evaluation framework of actual online gambling behaviour. Int Gambl Stud 2012;12:405–419.
15 Braverman J, Shaffer HJ: How do gamblers start gambling: identifying behavioral markers for high-risk internet gambling. Eur J Public Health 2012;22:273–278.
16 Broda A, et al: Virtual harm reduction efforts for Internet gambling: effects of deposit limits on actual Internet sports gambling behavior. Harm Reduct J 2008;5:27.
17 LaBrie R, Shaffer HJ: Identifying behavioral markers of disordered Internet sports gambling. Addict Res Theory 2011;19:56–65.
18 Labrie RA, et al: Inside the virtual casino: a prospective longitudinal study of actual Internet casino gambling. Eur J Public Health 2008;18:410–416.
19 LaBrie RA, et al: Assessing the playing field: a prospective longitudinal study of internet sports gambling behavior. J Gambl Stud 2007;23:347–362.
20 LaPlante DA, et al: Sitting at the virtual poker table: a prospective epidemiological study of actual Internet poker gambling behavior. Comput Human Behav 2009;25:711–717.
21 LaPlante DA, et al: Population trends in Internet sports gambling. Comput Human Behav 2008;24:2399–2414.
22 Nelson SE, et al: Real limits in the virtual world: self-limiting behavior of Internet gamblers. J Gambl Stud 2008;24:463–477.
23 Xuan Z, Shaffer H: How do gamblers end gambling: longitudinal analysis of Internet gambling behaviors prior to account closure due to gambling related problems. J Gambl Stud 2009;25:239–252.
24 Braverman J, et al: Using cross-game behavioral markers for early identification of high-risk internet gamblers. Psychol Addict Behav 2013;27:868–877.
25 Gray HM, LaPlante DA, Shaffer HJ: Behavioral characteristics of Internet gamblers who trigger corporate responsible gambling interventions. Psychol Addict Behav 2012;26:527–535.
26 Planzer S, Gray HM, Shaffer HJ: Associations between national gambling policies and disordered gambling prevalence rates within Europe. Int J Law Psychiatry 2014;37:217–229.
27 Smith G, Levere M, Kurtzman R: Poker player behavior after big wins and big losses. Manage Sci 2009;55:1547–1555.
28 Adami N, et al: Markers of unsustainable gambling for early detection of at-risk online gamblers. Int Gambl Stud 2013;13:188–204.
29 McBride J, Derevensky J: Internet gambling behavior in a sample of online gamblers. Int J Ment Health Addict 2009;7:149–167.
30 Gainsbury SM, et al: Greater involvement and diversity of Internet gambling as a risk factor for problem gambling. Eur J Public Health 2015;25:723–728.
31 Buth S, Stöver H: Glücksspielteilnahme und glücksspielprobleme in deutschland: ergebnisse einer bundesweiten repräsentativbefragung. Suchttherapie 2008;9:3–11.
32 Cox BJ, Enns MW, Michaud V: Comparisons between the South Oaks Gambling Screen and a DSM-IV-based interview in a community survey of problem gambling. Can J Psychiatry 2004;49:258–264.
33 Phillips JG, et al: Gambling involvement and increased risk of gambling problems. J Gambl Stud 2013;29:601–611.
34 Welte JW, et al: Risk factors for pathological gambling. Addict Behav 2004;29:323–335.
35 Gainsbury SM, et al: The prevalence and determinants of problem gambling in Australia: assessing the impact of interactive gambling and new technologies. Psychol Addict Behav 2014;28:769–779.
36 Philander KS, Abarbanel BL: Determinants of internet poker adoption. J Gambl Stud 2014;30:609–623.
37 LaPlante DA, Nelson SE, Gray HM: Breadth and depth involvement: understanding Internet gambling involvement and its relationship to gambling problems. Psychol Addict Behav 2014;28:396–403.
38 Billieux J, et al: Gambling and problem gambling in Switzerland. Addiction 2016;111:1677–1683.

39 Gainsbury S, Wood R: Internet gambling policy in critical comparative perspective: the effectiveness of existing regulatory frameworks. Int Gambl Stud 2011;11:309–323.
40 Annual Report 2014, S.F.C. Bern, Commission, Editor, 2014.
41 Grant JE, et al: Neurocognitive dysfunction in strategic and non-strategic gamblers. Prog Neuropsychopharmacol Biol Psychiatry 2012; 38:336–340.
42 Odlaug BL, et al: Strategic vs nonstrategic gambling: Characteristics of pathological gamblers based on gambling preference. Ann Clin Psychiatry 2011;23:105–112.
43 Cisco: Cisco IOS NetFlow. http://www.cisco.com/c/en/us/products/ios-nx-os-software/ios-netflow/index.html (cited November 10, 2014).
44 Pokernet: Best Mobile Poker Apps. http://www.pokernet.org/poker/best-mobile-poker-apps (cited November 10, 2014).
45 PokerScout: Top Online Poker Sites Directory. http://www.pokerscout.com/ (cited November 10, 2014).
46 Pokerstars: Pokerstars Mobile. https://www.pokerstars.com/mobile/ (cited November 2014).
47 Apache: Apache Hadoop. http://hadoop.apache.org/ (cited November 2014).
48 Apache: Spark Apache. http://spark.apache.org/ (cited November 2014).
49 Holtgraves T: Gambling, gambling activities, and problem gambling. Psychol Addict Behav 2009;23:295–302.
50 Campbell-Meiklejohn DK, et al: Knowing when to stop: the brain mechanisms of chasing losses. Biol Psychiatry 2008;63:293–300.
51 Suganuma N, et al: Using electronic media before sleep can curtail sleep time and result in self-perceived insufficient sleep. Sleep Biol Rhythms 2007;5:204–214.
52 Shochat T, Flint-Bretler O, Tzischinsky O: Sleep patterns, electronic media exposure and daytime sleep-related behaviours among Israeli adolescents. Acta Paediatr 2010;99: 1396–1400.
53 Primack BA, et al: Association between media use in adolescence and depression in young adulthood: a longitudinal study. Arch Gen Psychiatry 2009;66:181–188.
54 Parhami I, et al: Sleep and gambling severity in a community sample of gamblers. J Addict Dis 2012;31:67–79.
55 Parhami I, et al: Pathological gambling, problem gambling and sleep complaints: an analysis of the national comorbidity survey: replication (NCS-R). J Gambl Stud 2013;29:241–253.
56 Griffiths M: Internet abuse in the workplace – issues and concerns for employers and employment counselors. Journal of Employment Counseling 2003;40:87–97.
57 Griffiths MD, Parke J: The Social Impact of Internet Gambling. Social Science Computer Review 2002;20:312–320.
58 Hing N, et al: A Case of Mistaken Identity? A Comparison of Professional and Amateur Problem Gamblers. J Gambl Stud 2016;32: 277–289.
59 Hing N, et al: What's in a Name? Assessing the Accuracy of Self-identifying as a Professional or Semi-Professional Gambler. J Gambl Stud 2015;31:1799–1818.